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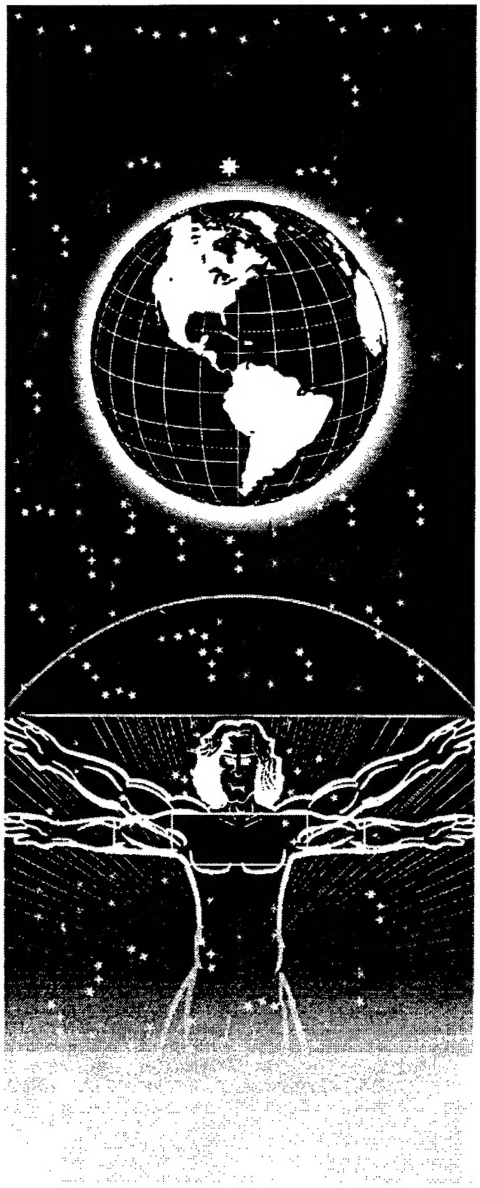

UNITED STATES AIR FORCE RESEARCH LABORATORY

DETERMINANTS OF ENLISTED AIR TRAFFIC CONTROLLER SUCCESS

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13. ABSTRACT *(Maximum 200 words)*

This report provides a brief historical overview of air traffic controller (ATC) selection, reviews current US Air Force selection procedures for enlisted ATC trainees, and summarizes results of three recent studies. Study 1 examined the validity of the operational selection test (i.e., Armed Services Vocational Aptitude Battery, or ASVAB) against apprentice (3-level) training performance. Study 2 evaluated the effect of alternative selection procedures on training attrition and eligibility for training. Study 3 reviewed the results of a survey designed to identify the personnel characteristics and organizational factors that influence training and job performance of enlisted ATCs. Results indicate the ASVAB composites had acceptable validity for predicting apprentice-level training performance (Study 1). Alternative cut-score analyses (Study 2) reveal that raising the minimum General composite in order to reduce attrition by 5% leads to an unacceptable 20% reduction in the number of eligible ATC candidates. Using a different composite (Electronic) for training qualification would have less of an overall impact on qualification rate, but would disproportionately disqualify females for ATC training. Results of the survey (Study 3) indicate that enlisted ATCs were generally satisfied and motivated. In addition, job incumbents identified several abilities required for on-the-job performance that are not measured by current selection procedures (i.e., ASVAB). These included memorization and retention of new information, spatial orientation/visualization, ability to work well in stressful environments, ability to shift between two or more sources of information, and ability to combine and organize information. Implications for enlisted ATC selection and training as well as future research directions are discussed.

14. SUBJECT TERMS

Abilities; Air traffic control; Air Traffic Controllers; Armed Services Vocational Aptitude Battery; ASVAB; ATC; Attrition; Enlisted personnel; Job satisfaction; Job skills; Personnel selection; Personnel training; Training

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PREFACE

This project was initiated in response to a request from the Air Education and Training Command (AETC/XO) in July 1996 to conduct research regarding human systems needs for weapons directors and air traffic controllers. The air traffic controller (enlisted Air Force Specialty 1C131) portion was conducted under Work Unit 1123-B1-08, Correlates of Air Traffic Controller Success, in support of air traffic controller screening. The laboratory work unit monitor was Dr Frederick M. Siem.

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DETERMINANTS OF ENLISTED AIR TRAFFIC CONTROLLER SUCCESS

INTRODUCTION

A review of three US Air Force (USAF) Class "A" mishaps in 1993 and 1994 implicated air traffic controller (ATC) loss of situational awareness as a contributing factor. As a result, the Air Force undertook several initiatives to review ATC operations, including a "tiger team" examination of the manpower and personnel structure of the career field. The tiger team included representatives from Air Education and Training Command (AETC), the Air Force Flight Standards Agency (AFFSA), and the Second Air Force.

One of the tiger team's recommendations was to review current ATC screening procedures for possible improvements in the selection of ATC trainees. One concern that emerged from the tiger team review was the reliance for ATC selection solely on the Armed Services Vocational Aptitude Battery (ASVAB) (Department of Defense, 1984), a paper-and-pencil, multiple-choice test. The tiger team perception was that the ASVAB lacked measures of specific abilities related to success as an air traffic controller, such as attention span, concurrent multiple task performance, decision making, and spatial reasoning.

The tiger team also was concerned that, based on observed attrition rates both in apprentice (3-level) technical training and in upgrade (5-level) training, the screening system was deficient in identifying ATC trainees likely to succeed in the career field. Recent attrition rates for 3-level technical training are shown in Figure 1. As these rates and the associated data in Table 1 indicate, attrition has increased since 1990, despite an overall reduction in the number of air traffic controller trainees.

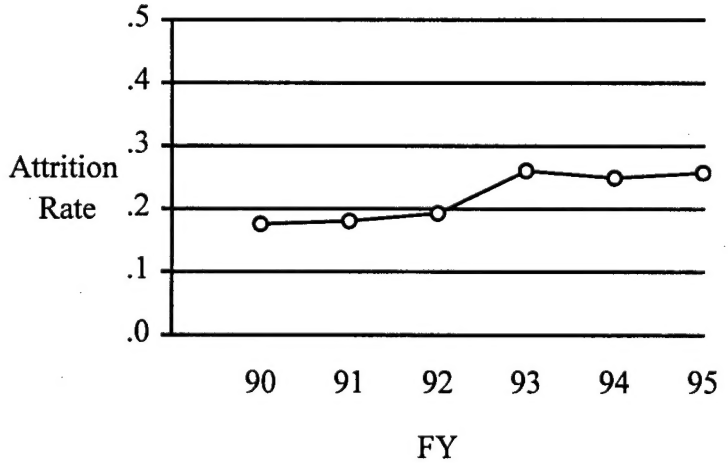

Figure 1. Attrition Rates in Air Traffic Controller Apprentice (3-Level) Training: 1990-1995

Table 1. Air Traffic Controller Apprentice (3-Level) Training Outcomes: 1990-1995

	Year					
Training Outcome	1990	1991	1992	1993	1994	1995
Graduates	848	676	454	139	92	139
Eliminees	176	137	85	30	46	52
Total	1024	813	539	169	138	191

As a result of the tiger team report, AETC asked the Air Force Research Laboratory, (formerly known as Armstrong Laboratory) to evaluate current ATC screening procedures and recommend potential enhancements. Air Force Research Laboratory personnel approached the ATC attrition problem by (a) reviewing the literature on ATC selection research within the USAF, as well as other military services and the Federal Aviation Administration (FAA); (b) analyzing archival data on the relationship between ASVAB scores and performance in apprentice (3-level) technical training; and (c) surveying incumbent USAF ATC personnel. The results of the incumbent survey are described in detail in Grimes, Weissmuller, and Driskill (1997) and summarized herein.

A Brief History of ATC Selection

Since WWII, both military and civilian ATC trainees have been selected by means of psychological tests. The core abilities measured have been measures of cognitive ability including tests of numeric and symbolic reasoning, declarative and inductive reasoning, perceptual speed, and spatial (Hättig, 1991).

In the 1970s the FAA began the development of a simulation-based ATC job-sample test known as the Controller Decision Evaluation test (CODE) (Pickrel & Dailey, 1979). The test consisted of a 45minute movie that presented simulated air traffic in real time as it crossed an actual controller display. Several FAA studies reported incremental validity for the CODE test (e.g., Colmen, 1979). A paper-and-pencil analog of the CODE test called the Multiplex Controller Aptitude Test (MCAT) was subsequently developed and validated by the FAA (Dailey & Pickrel, 1984; Pickrel & Dailey, 1979). Stoker, Hunter, Batchelor, and Curran (1987) examined the validity and incremental validity of the MCAT and four experimental perceptual and spatial abilities tests (Object Completion, Rotated Blocks, Perceptual Abilities, and Electrical Maze) for predicting enlisted USAF ATC training outcome. Regression analyses revealed that the MCAT and Rotated Blocks tests incremented the validity of the ASVAB

composites when predicting a dichotomous ATC pass/fail training criterion. Despite Stoker et al.'s (1987) recommendations, neither the MCAT nor the Rotated Blocks tests were operationally implemented to augment the ASVAB for USAF enlisted ATC trainee selection.

Starting in the late 1970s, ATC selection became a major topic in Europe (Hättig, 1991). The German Armed Forces began development of an ATC job-sample test called the Air Traffic Control test and the United Kingdom (UK) Royal Air Force (RAF) announced the development of the first completely computer-based ATC selection test battery (Hunter & Schmidt, 1986). The Union of Soviet Socialist Republics (USSR) implemented a new selection system for civilian air traffic controllers that combined information from nine paper-and-pencil aptitude tests and a neuropsychological examination (Zeitseva & Togarev, 1985).

Advances in ATC selection have continued in the 1990s. The FAA studied the utility of a 5-day, computer-based test battery, the Air Traffic Control Specialist/Pre-Training Screen (ATCS/PTS) for replacing a 9-week Academy Nonradar Screen Program (Broach & Brecht-Clark, 1993). The computer-based battery included two information processing tests and a simplified radar-based ATC work sample test. A series of studies indicated (1) the ATCS/PTS was useful for predicting performance in the 9-week FAA Academy Nonradar Screen Program and (2) was as valid for predicting progress in field technical training as were scores from the 9-week FAA Academy Nonradar Screen. Based on these results, in 1992 the FAA decided to terminate the Academy Nonradar Screen Program and supplement its paper-and-pencil ATC selection test battery with the ATCS/PTS.

More recently, as the result of an ATC task analysis (Bailey, 1997), the RAF revised its ATC selection test battery (Bailey, 1998). The revised ATC taxonomy and resulting test battery is similar in content to that described by Hunter and Schmidt (1986), except that the new taxonomy is more detailed. Hunter and Schmidt's Reasoning domain (ability to solve problems involving verbal, numerical, or diagrammatic information) was divided into discrete numerical and verbal sections and their Mental Speed domain was renamed Work Rate. The revised RAF ATC selection battery includes tests of numerical, verbal, spatial, attentional capacity, and work rate.

USAF ATC Screening and Training

Applicants for the enlisted ATC career field are required, as are all applicants for USAF enlisted jobs, to take the ASVAB prior to joining the military[1]. The ASVAB is a 10 test, multiple aptitude battery that takes about 2.5 hours to administer. Its factor structure (Ree & Carretta, 1994) and reliability (Earles & Ree, 1992) have been studied, and it has been validated for training (Earles & Ree, 1992; Ree & Earles, 1991;) and job performance (Ree & Earles, 1992;

[1] Officers also work in the ATC career field but mainly in a supervisory capacity that requires only minimal proficiency as a controller. The officer corps will not be discussed in this report as the main concern is with attrition of enlisted personnel.

Ree, Earles, & Teachout, 1994). It is administered at Military Enlistment Processing Stations and other cites within the continental United States, as well as at locations overseas.

The tests are General Science (GS), Arithmetic Reasoning (AR), Word Knowledge (WK), Paragraph Comprehension (PC), Numerical Operations (NO), Coding Speed (CS), Auto and Shop Information (A/S), Mathematics Knowledge (MK), Mechanical Comprehension (MC), and Electronics Information (EI). The USAF combines the tests into composites as shown in Table 2. The Armed Forces Qualification Test (AFQT) score is used for entry into the US military regardless of job specialty, and four separate Aptitude Indices are used by the Air Force for determining qualifications for specific jobs: Mechanical (M), Administrative (A), General (G), and Electronic (E).

Table 2. US Air Force ASVAB Composites

Test		Composite				
		AFQT	M	A	G	E
General Science	GS		X			X
Arithmetic Reasoning	AR	X			X	X
Word Knowledge	WK	2X		X	X	
Paragraph Comprehension	PC	2X		X	X	
Numerical Operations	NO			X		
Coding Speed	CS			X		
Auto & Shop Information	A/S		2X			
Mathematics Knowledge	MK	X				X
Mechanical Comprehension	MC		X			
Electronics Information	EI					X

The minimum qualifying AFQT percentile score for Air Force entrance is 40[2]. In addition, entry into the ATC career field requires passing a flight physical and a Reading Aloud Test, vision correctable to 20/20, and a minimum score of 53 on the G composite. (US Air Force Personnel Center, 1995).

Applicants with qualifying scores on the AFQT and on the G composite are selected for ATC training in one of two ways. Some are selected for ATC training prior to Basic Military Training (BMT). Other applicants enter BMT with a guaranteed job in one of four broad career

[2] In addition to a minimum AFQT score of 40, acceptance into the US Air Force depends on other factors such as a credit check and achieving age 18 prior to graduation from BMT.

clusters (M, A, G, or E) and are assigned to a training specialty as part of a classification process during BMT. In either case, ATC candidates are provided only with minimal descriptions of the nature of a controller's actual job duties, and the information that is provided tends to describe only the more attractive aspects of the job.

Upon completion of BMT, ATC students attend an apprentice (3-level) training course (E3ABRC13131) at Keesler AFB in Biloxi, Mississippi. The course consists of 72 hours of instruction divided into four blocks (see Table 3). The fourth block consists of administration of the FAA ATC certification test which must be passed successfully to graduate from 3-level training (POI dated 22 April 1996).

Students can be eliminated from training at any point for a variety of reasons. The most common reasons for elimination are inadequate performance, self-elimination, academic failure, and a phenomenon known as "fear of controlling." Attrition tends to stay at about the same rate through the 14-week course. Anecdotal evidence indicates that the primary reason for attrition may vary somewhat by block of training, insofar as poor academic performance and self-elimination are more common in the first block (i.e. air traffic control fundamentals) than in the rest of the course.

Table 3. ATC Apprentice (3-Level) Training Course Length.

Block	Content	Duration in Days
1	Air Traffic Control Fundamentals	9
2	Control Tower Operations	25
3	Radar Approach Control Operations	37
4	Control Tower Operation Certification	1

The cost of graduating a student from apprentice (3-level) training in FY97 dollars, based on variable costs only, is $15,791. Based on an average completion of 36 days (50%), each eliminee represents a loss of about $7,895. Assuming a yearly product rate of 637 students (the FY98 Training Production Requirement) and an estimated attrition rate of 25%, attrition costs total to roughly $1,250,000 annually. Therefore, a reduction in attrition of only 5% would represent substantial cost savings ($250,000).

Upon graduation from 3-level training, controllers proceed to an operational assignment in either a tower or a radar approach control (RAPCON) position, depending on the needs of the Air Force. Subsequent assignments also can vary between the two types of positions.

Upgrades to 5- and 7-level occur as controllers gain more experience. Typically, it takes about 1.5 to 2 years for apprentice controllers to become fully qualified at their first base of assignment. Seven-level (craftsman) certification includes a formal 9-day course conducted at Keesler AFB. This course focuses mostly on the development of supervisory skills. The entire 7-level training sequence requires about 18 months to complete.

STUDY I: ASVAB UTILIZATION

Study I examined the validity of the ASVAB composites for predicting apprentice-level ATC training performance. The specific research question was whether an aptitude index other than G (the one currently used) might be a more valid predictor of enlisted ATC training performance.

Method

Participants. The sample consisted of 1,069 USAF enlisted personnel who entered ATC training in calendar years 1990-1995 and who were tested on the ASVAB[3]. Most of the participants were male (71.1%) and White (81.2%). Table 4 shows the racial composition of the sample. Education level for all participants was at least high school graduate or equivalent. Age at entry into the military ranged from 17 to 27 years. The graduation rate for 3-level training in the sample was 75.2% (804/1069). The most common reason for attrition was poor academic performance (n = 161); the other 104 eliminations occurred for a variety of reasons.

Table 4. ASVAB Validation Sample Racial Composition.

Race	N	%
White	864	81.2
African-American	127	11.9
Hispanic	51	4.8
Native American	4	0.4
Asian	15	1.4
Other/Unknown	3	0.3

Measures. Predictors were the ASVAB M, A, G, and E composites. The criteria included final school grade (FSG) during technical training (graduates only) and passing/failing (P/F) training (graduates and eliminees). FSG ranged from 70 to 99 and represented the average percent correct on several multiple choice tests.

Procedures. An historical database of ASVAB scores was matched against a technical training database. Those with ASVAB scores who were identified as entering either course 27230 (prior to 1 November 1993) or course 1C131 (after 1 November 1993) were retained.

[3] Only participants tested on the ASVAB forms in common use during that period were used in the analyses. The following ASVAB forms were used as the selection criterion: 15, 16, 17, 20, 21, 22, and CAT-ASVAB 01 and 02.

Correlations were corrected for restriction in range (Lawley, 1943) using means and standard deviations from an historical database of Air Force enlisted applicants tested on the same forms of the ASVAB (see Study 2). Next, the validity of a summed composite (M + A + G + E) and a regression-weighted composite of the 4 ASVAB scores was computed in both observed and corrected for range restriction form. Finally, after correction for range restriction, correlations of the ASVAB composites and ATC pass/fail training score were corrected for dichotomization of the criterion.

Results

Final School Grade. As shown in Table 5a, both before and after correction for range restriction, the G (.372 and .569) and E composites (.379 and .561) were the best predictors of final school grade. The other two ASVAB composites were less valid (M, .293 and .428; A, .194 and .403). The four ASVAB composites were then summed and the resulting score correlated with FSG. The correlation was .394 for the observed data and .577 for the data corrected for range restriction. Finally, FSG was regressed on the four ASVAB composites. The multiple R was .411 for the observed data and .594 after range restriction correction. Clearly, after either G or E has been entered, the other ASVAB composites do little to increment the prediction of FSG.

Passing/Failing Training. The E composite was the best predictor of passing/failing training, both before and after correction for range restriction (.353 and .454; see Table 5b). The M (.315 and .396) and G (.270 and .391) composites were similar in validity. The A composite had the lowest validity (.102 and .244). As with the FSG analyses, the four ASVAB composites were summed and correlated with ATC P/F. The correlation was .358 for the observed data and .458 for the corrected data. The multiple R for the regressions of ATC P/F on the four composites were .364 and .464 for the observed and corrected correlations. As observed with FSG, the E composite alone was nearly as predictive of ATC P/F as when used in combination with the other ASVAB composites. The fully corrected (range restriction and dichotomization) validities present a similar picture, with all values increasing as expected: M (.518), A (.519), G (.510), E (.593), unit-weighted composite (.599), and regression-weighted composite (.606).

Table 5. Correlation Matrix (US Air Force ASVAB Composites and ATC Training Performance)

a. Final School Grade (FSG; n = 804):

Score	M	A	G	E	FSG
M	1.000	0.056	0.503	0.724	0.293
A	0.218	1.000	0.366	0.203	0.194
G	0.597	0.622	1.000	0.770	0.372
E	0.754	0.488	0.856	1.000	0.379
FSG	0.428	0.403	0.569	0.561	1.000

b. Passing/Failing (P/F; n = 1,069):

Score	M	A	G	E	P/F
M	1.000	0.059	0.517	0.743	0.315
A	0.218	1.000	0.357	0.200	0.102
G	0.597	0.622	1.000	0.765	0.270
E	0.754	0.488	0.856	1.000	0.353
P/F	0.396	0.244	0.391	0.454	1.000

Note. Correlations above the diagonal are observed. Those below the diagonal were corrected for range restriction (Lawley, 1943).

Figure 2 displays the proportion of graduates and eliminees by G decile. The pattern clearly demonstrates that ATC trainees with higher G composite scores are more likely to graduate training (53-59: 64.3%; 60-69: 67.3%; 70-79: 77.6%; 80-89: 83.1%; 90-99: 96.5%).

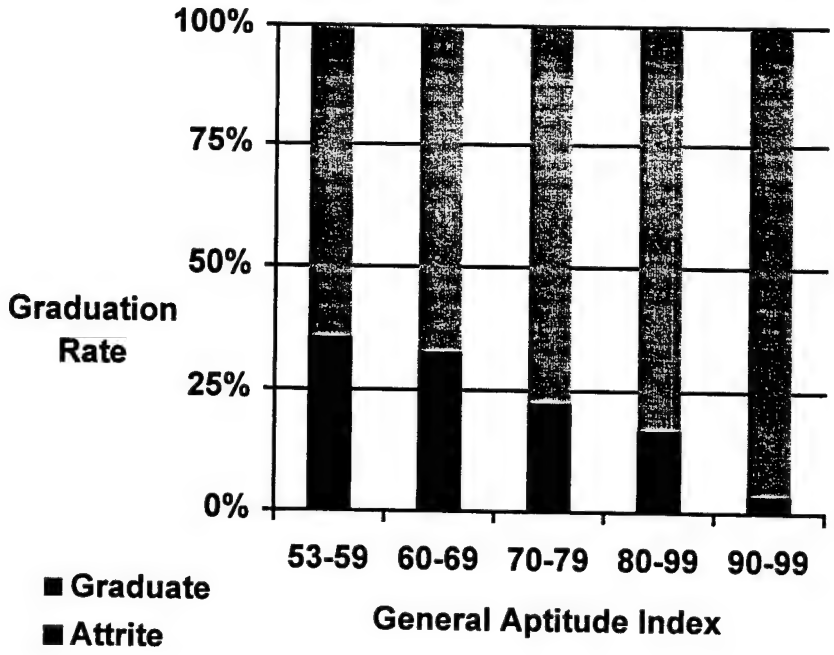

Figure 2. Air Traffic Controller Apprentice Training Attrition Rate by ASVAB G Composite Decile

STUDY 2: ALTERNATIVE CUT SCORE ANALYSIS

One method of improving the effectiveness of the G composite is to raise the minimum or "cut" score required for entrance into the ATC career field. Inspection of the graduation rates by individual G percentiles (see Figure 2) suggested that raising the minimum from 53 to 62 would produce a 5.4% decrease in the overall attrition rate from 25% to 20%. Alternatively, the E composite might be substituted for the G composite, with a cut score of 54 producing a reduction in attrition comparable to a cut score for G at 62 (4.9%).

Raising or changing a cut score can result in reduced attrition, but may have other less desirable consequences. For example, a cut score of the 90th percentile would clearly screen out a high number of applicants likely to fail, but would also "qualify" too few trainees to meet organizational needs. More realistically, changes in cut score may have deleterious consequences on the rate of ethnic minorities and females who qualify for a job. Study 2 was therefore conducted to address possible consequences of raising the G composite minimum or substituting an E composite minimum requirement of 54 for the present G minimum of 53.

Method

Participants. The sample consisted of 216,207 USAF enlisted applicants who tested on ASVAB forms 15, 16, 17, or CAT-ASVAB 01 or 02. There were 154,407 males and 61,800 females; and 161,402 Whites, 37,478 African-Americans, 9,783 Hispanics, 902 Native Americans, and 4,467 Asians. Racial identity information was lacking on 2,175 records.

Procedure. The data were extracted from an historical database of USAF applicants who tested on the same forms of the ASVAB as the ATC trainee sample in the previous study.[4]

Results

Raising the Minimum G Composite Score

Males vs. females. As previously noted, the current minimum G composite value is 53. Raising the minimum qualifying G score to 62 reduced the number of eligible males from 93,369 to 77,915, representing an overall reduction of about 17% in the number of eligible males. For females, the number of eligible candidates fell from 31,592 to 23,709, an overall reduction of about 25%.

Whites vs. African-Americans. Raising the minimum G composite from 53 to 62 reduced the number of eligible White applicants from 107,585 to 87,614, an overall reduction of 20%. For African-Americans, the number of eligible candidates would fall from 12,232 to 8,087 (i.e., an overall reduction of about 34%).

Using a Different Composite

Males vs. females. As previously noted, the current minimum G composite for enlisted ATC training qualification is 53. Changing the eligibility requirement to be an E composite of 54 *increased* the number of eligible male candidates from 93,369 to 100,193 (i.e., an overall *increase* of about 7% for males). However, if this procedure were used, the number of eligible female candidates would *decrease* from 31,392 to 24,334, representing an overall reduction of about 23% in the number of eligible females.

Whites vs. African-Americans. If the minimum qualifying score were changed to be an E score of 54, the number of eligible White applicants would be reduced from 107,585 to 104,267. This represents an overall reduction of only about 3% in the number of eligible Whites. For African-Americans, the number of eligible applicants would fall from 12,223 to 11,640, representing an overall reduction of only about 5%.

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[4] The ASVAB data from these applicants provided the means and standard deviations used for correcting the ASVAB data in the previous study for restriction in range.

STUDY 3: ATC INCUMBENT SURVEY

Although the ASVAB composites were found to be valid predictors of apprentice (3-level) training, program managers for the enlisted ATC career field were concerned that the ASVAB could not identify candidates likely to fail for non-academic reasons. They wanted to determine whether there were additional ability factors not covered by the ASVAB that could help improve prediction of training performance.

In response to program managers' concerns, a coordinated effort was undertaken to survey enlisted ATCs to identify the personnel characteristics and organizational factors that may influence training and job performance. It was intended that results of this effort be used to help design a preliminary selection system.

Method

Participants. The survey sample consisted of 181 incumbent enlisted air traffic controllers. The majority of the participants were male (n = 155; 85.6%). The grade structure of the sample is shown in Table 6.

Table 6. Grade Structure of Survey Sample

Grade	N	Percent
E-4	41	22.7
E-5	71	39.2
E-6	31	17.1
E-7	27	14.9
E-8	3	1.7
E-9	2	1.1
Missing	6	3.3

Measures

The survey (see Appendix A) was designed to assess the importance of several factors thought to underlie ATC performance and to define key issues related to success in the enlisted ATC career field. These factors included basic abilities, organizational aspects, and the perceived working environment. Items that addressed organizational and personal concerns were developed based on interviews with trainers and program managers. The survey was divided into four sections: Background Information, Motivation, Situational, and ATC Abilities.

Background information. The questions in this section focused on basic demographic information, as well as general information concerning job satisfaction. They concerned military grade, qualifications, and base of assignment. Also included were five general questions used by

the Occupational Measurement Squadron to measure job satisfaction (Gould, 1976, 1978; Tuttle, Gould, & Hazel, 1975). These questions assessed job interest, training, the use of talents, sense of accomplishment, and the likelihood of reenlistment. The questions in this section used mainly fill-in-the-blank or predetermined alternative response formats.

Motivation. This section assessed preferences for different types of work environments and the extent to which the ATC career field was rewarding. Responses to these questions were on a 7-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (7).

Situational. This section measured the quality of life, acceptance of responsibility, decision making, and attitudes toward temporary duty assignments. It also included questions regarding technical instructors' concern toward students. Responses to questions in the Situational section used the same Likert scale as used in the Motivation section.

ATC abilities. The final section assessed the importance of several abilities for successful ATC performance relative to their importance for performance in other Air Force specialties. These items were based on the 28 task/job requirements defined by Dittmar, Weissmuller, Driskill, Hand, and Earles (1994). A scale from very low (1) to very high (7) was used to indicate the ability level required to complete the task discussed in each question. A score of 4 or greater on a given question indicated that the ability level required to perform the task should be higher than that typically found in other Air Force specialties.

Procedures. Surveys were mailed to each duty location and supplied to participants by their supervisor. The survey was distributed to 200 incumbent air traffic controllers at 19 bases. Two forms (i.e., paper-and-pencil or diskette) of the survey were distributed. About half (93 of 200) of the respondents chose the automated format. Once completed, the surveys were placed in a sealed envelope and returned to Brooks AFB for analysis. Participants provided informed consent per USAF Institutional Review Board procedures prior to completing the survey.

Results

Background Information. Examination of responses to the job satisfaction questions revealed that generally the enlisted ATCs had positive feelings about their job (see Appendix B, Table B-1). Comparing their job to other enlisted specialties, the air traffic controllers rated it as more interesting, providing a greater likelihood of using their training and talents, and providing a greater sense of accomplishment. Enlisted ATCs also stated that they were seldom made to feel uncomfortable in their job and usually were treated with respect. When asked about the likelihood of reenlistment (question #5), about 16% indicated they would retire (with at least 20 years service), 25% indicated that they would probably/definitely not reenlist, and 60% indicated that they probably/definitely would reenlist.

Motivation. Table B-2 in Appendix B summarizes the results from the Motivation section of the survey. Mean responses indicate a very positive attitude toward the ATC career field. As noted earlier, responses were made using a 7-point scale from (1) Strongly Disagree to

(7) Strongly Agree. Means for 7 of the 12 questions were 6 or greater and indicated that the respondents liked the work environment and the high level of responsibility associated with their duties and that they found the job rewarding and exciting.

Situational. Responses to the Situational questions are summarized in Appendix B, Table B-3. Overall, responses to these questions can best be described as neutral (i.e., neither extremely positive or negative). Enlisted ATCs were neither extremely satisfied nor dissatisfied with the quality of life, temporary duty assignments, and technical instructors' concern toward students. The highest rated questions indicated they felt the ATC job carried a greater level of responsibility than other enlisted specialties (questions #32 and 35) and that mistakes were treated more severely for ATCs than other enlisted specialties (question #41).

ATC Abilities. Questions regarding the importance of various abilities for successful enlisted ATC performance were divided into two sections (i.e., agree-disagree scales, questions #42-57; requirements scales, questions #58-86). Tables B-4 and B-5 of Appendix B summarize the responses to the agree-disagree and requirements scales, respectively.

As previously noted, responses to the agree-disagree questions used a 7-point scale that ranged from (1) Strongly Disagree to (7) Strongly Agree. Overall, the means for these questions were very high, indicating that respondents felt these abilities to be important for successful job performance. The mean value across all 16 questions was 5.975. Mean values for individual questions ranged from 4.1 to 6.7 and 12 of the 16 questions had values of 6 or greater. The ability rated least important (#48, $\underline{M}$ = 4.1) had to do with understanding basic geometry. The abilities rated most important dealt with the ability to prioritize (#50, $\underline{M}$ = 6.7), assimilate information and make correct decisions (#51, $\underline{M}$ = 6.6), work well in stressful environments (#52, $\underline{M}$ = 6.5), and anticipate what has not yet happened (#53, $\underline{M}$ = 6.5).

For questions #58-86, respondents rated the importance of several abilities *relative* to their importance for other enlisted specialties. Scale values ranged from (1) Very Low to (7) Very High. Results were consistent with a view of the ATC job requiring high levels of cognitive capacity and information processing and the ability to work well under stress. The abilities rated least important had to do with exerting muscular strength (#74, $\underline{M}$ = 2.8) and the psychomotor abilities of control precision (#76, $\underline{M}$ = 3.3) and multi-limb coordination (#77, $\underline{M}$ = 3.7). The most highly rated abilities were memorization and retention of new information (#64, $\underline{M}$ = 6.1), spatial orientation/visualization (#70, $\underline{M}$ = 6.1), the ability to work well in stressful environments (#84, $\underline{M}$ = 6.1), the ability to shift between two or more sources of information (#66, $\underline{M}$ = 6.0), and combine and organize information (#68, $\underline{M}$ = 6.0).

DISCUSSION

Results from Study 1 indicated that current USAF selection procedures (i.e., use of ASVAB composites) offer good prediction of enlisted ATC training performance. ASVAB validities were consistent with prior research findings for enlisted ATC trainees (Stoker et al., 1987) and for a similar enlisted training specialty, weapons directors (Ree & Carretta, in press).

Alternative cut score analyses (Study 2) were done to determine the impact on attrition rate for either raising the minimal G composite from 53 to 62 or for using the E composite instead of G. Results indicated that although raising the G composite would reduce attrition by about 5% (from about 25% to 20%), the number of enlistees eligible for ATC training would decline by over 20%, making it difficult to recruit enough candidates for training. Using the E composite in lieu of the G composite also would reduce attrition by about 5%, but would have less of an overall impact on reducing the number of eligible candidates. However, the level of impact would vary greatly by sex. Using a minimal E composite of 54 would actually *increase* the number of eligible male candidates by about 7%, but *decrease* the number of eligible female candidates by about 23%. Using the E composite would be unacceptable as it would produce adverse impact for female candidates.

Although the ASVAB composites were found to be valid predictors of apprentice (3-level) training, program managers for the enlisted ATC career field were concerned that the ASVAB could not identify candidates likely to fail for non-academic reasons. They wanted to determine whether there were additional ability factors not covered by the ASVAB that could help improve prediction of training performance. In response to program managers' concerns, a coordinated effort was undertaken to survey enlisted ATCs to identify the personnel characteristics and organizational factors that may influence training and job performance. It was intended that results of this effort be used to help design a preliminary selection system.

Survey results indicated a high level of job satisfaction and motivation for enlisted ATCs. Respondents liked the work environment and the high level of responsibility associated with their duties and said they found the job rewarding and exciting.

Responses to the situational questions indicated that, in most respects, enlisted ATCs felt their job to be comparable to other enlisted specialties. The most notable exceptions were that ATCs felt their job carried a greater level of responsibility than other enlisted specialties and that mistakes were treated more severely for ATCs than other enlisted specialties.

Respondents identified several abilities needed for successful on-the-job performance that are not measured by current selection procedures (i.e., ASVAB). These included memorization and retention of new information, spatial orientation/visualization, the ability to work well in stressful environments, the ability to shift between two or more sources of information, and the ability to combine and organize information. These survey results are consistent with a recent ATC job analysis conducted by the RAF (Bailey, 1997). The most important abilities in the RAF analysis were spatial (i.e., reasoning/visualization), attentional capacity (ability to process and store information in real time; deal with multiple tasks involving auditory/visual information; concentrate over long periods of time; note and remember changes over short/long periods), and work rate (i.e., solve simple problems quickly and accurately).

Based on the results of the ability requirements survey, US Air Force ATC program managers felt that a screening device that measures these abilities may help reduce attrition at the technical training school. As a result, the USAF has begun a study to evaluate the utility of a "job

sample" test for enlisted ATC selection. In this test, which was developed by the FAA (ATCS/PTS; see Broach & Brecht-Clark, 1993), participants must control aircraft, adjusting their speed, altitude, and direction in order to send them to their proper destination (airport or transfer gate; see Figure 3 for a notional representation). Although data collection has begun, this project is in an early stage and is expected to take about another year to complete. Analyses will focus on the predictive utility of the job sample test and whether or not it adds to the predictiveness of the ASVAB.

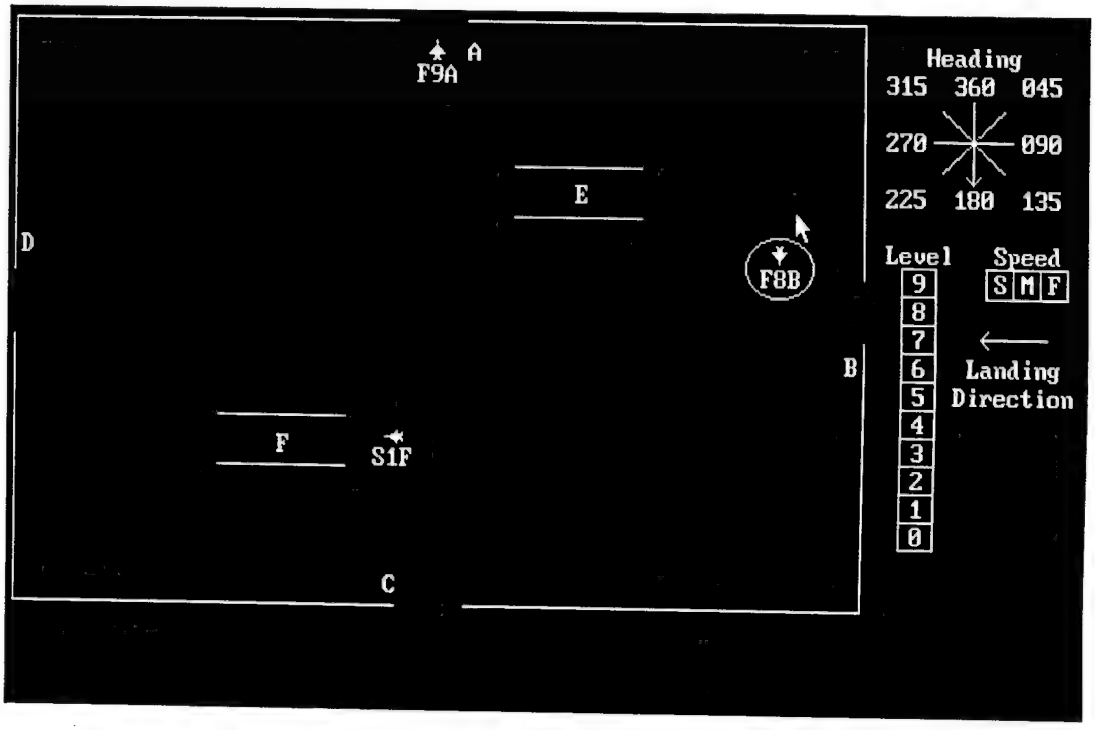

Figure 3. Notional Representation of ATC Work Sample Test

As previously noted, a similar validation study was conducted by the US Air Force in the mid-1980's (Stoker et al., 1987). In that study, the validity and incremental validity of several experimental tests for predicting enlisted ATC training outcome were examined in the presence of the ASVAB composites. The experimental tests included a paper-and-pencil ATC job sample test (Multiplex Controller Aptitude Test or MCAT) and 4 paper-and-pencil tests of perceptual and spatial abilities (Object Completion, Rotated Blocks, Perceptual Abilities, and Electrical Maze). Regression analyses revealed that the MCAT and Rotated Blocks tests incremented the validity of the ASVAB composites when predicting a dichotomous ATC pass/fail training criterion. Despite Stoker et al.'s recommendations, neither the MCAT nor the Rotated Blocks tests were operationally implemented to augment the ASVAB for enlisted ATC candidate selection. Based on the results of Stoker et al., we are optimistic that the experimental computer-based ATC job sample test (see Figure 3) will demonstrate validity and incremental validity for enlisted ATC training.

REFERENCES

Bailey, M. (1997). *Air traffic controller task analysis* (Psychologist Report 7/97). Cranwell, UK: Royal Air Force, Directorate of Recruiting, Selection, and Initial Officer Training.

Bailey, M. (1998). *Revised air traffic controller test battery* (Psychologist Report 1/98). Cranwell, UK: Royal Air Force, Directorate of Recruiting, Selection, and Initial Officer Training.

Broach, D., & Brecht-Clark, J. (1993). Validation of the Federal Aviation Administration air traffic control specialist pre-training screen. *Air Traffic Control Quarterly, 1*, 115-133.

Colmen, J. G. (1979). Prediction success for air traffic controllers. *Proceedings of the 21st Annual Conference of the Military Testing Association*, San Diego, CA, 30-41.

Dailey, J. T., & Pickrel, E. W. (1984). Development of the Multiplex Controller Aptitude Test. In S. B. Sells, J. T. Dailey, & E. W. Pickrel (Eds.), *Selection of air traffic controllers* (FAA-AM-84-2), (pp. 281-297). Washington, DC: FAA Office of Aviation Medicine.

Department of the Air Force (1996). *Plan of instruction: Air traffic control operations apprentice and combat control apprentice (*POI E3ABR1C131 000). Keesler AFB, MS: Keesler Training Center.

Department of Defense (1984). *Armed Services Vocational Aptitude Test Battery test manual.* North Chicago: United States Military Enlistment Processing Center.

Dittmar, M. J., Weissmuller, J. J., Driskill, W. E., Hand, D. K., & Earles, J. A. (1994). *Methodology for identifying abilities for job specialties (MIDAS)* (AL/HR-TP-1994-0008, AD 279 919). Brooks AFB, TX: Armstrong Laboratory, Human Resources Directorate, Manpower and Personnel Research Division.

Earles, J. A., & Ree, M. J. (1992). Training validity. *Educational and Psychological Measurement, 54,* 721-725.

Gould, R. B. (1976). *Review of an Air Force job satisfaction research project: Status report through September 1996* (AFHRL-TR-76-75, AD A035 684). Brooks AFB, TX: Air Force Human Resources Laboratory, Occupation and Manpower Research Division.

Gould, R. B. (1978). *Air Force Occupational Attitude Inventory development* (AFHRL-TR-78-60, AD A062 987). Brooks AFB, TX: Air Force Human Resources Laboratory, Occupation and Manpower Research Division.

Grimes, G. K., Weissmuller, J. J., & Driskill, W. E. (1997). *Correlates of air traffic controller success.* Unpublished manuscript, Metrica, Inc., San Antonio, TX.

Hättig, H. J. (1991). Selection of air traffic control cadets. In R. Gal & A. D. Mangelsdorff (Eds.), *Handbook of Military Psychology* (pp. 115-129). Chichester, England: Wiley.

Hunter, D., & Schmidt, V. (1986). *A computer-based test battery for screening fighter and air traffic controllers* (Memo. No 8/86). London, UK: Director Science (Air) Ministry of Defence.

Lawley, D. N. (1943). A note on Karl Pearson's selection formulae. *Proceedings of the Royal Society of Edinburgh, Section A, 62, Part 1,* 28-30.

Pickrel, E. W., & Dailey, J. T. (1979). Development of the Multiplex Controller Aptitude Test. *Proceedings of the 21st Annual Conference of the Military Testing Association*, San Diego, CA, 60-67.

Ree, M. J., & Carretta, T. R. (1994). Factor analysis of ASVAB: Confirming a Vernon-like structure. *Educational and Psychological Measurement, 54,* 457-461.

Ree, M. J., & Carretta, T. R. (in press). Lack of ability is not always the problem. *Journal of Business and Psychology.*

Ree, M. J., & Earles, J. A. (1991). Predicting training success: Not much more than *g*. *Personnel Psychology, 44,* 321-332.

Ree, M. J., & Earles, J. A. (1992). Intelligence is the best predictor of job performance. *Current Directions in Psychological Science, 1,* 86-89.

Ree, M. J., Earles, J. A., & Teachout, M. S. (1994). Predicting job performance: Not much more than *g*. *Journal of Applied Psychology, 79,* 518-524.

Stoker, P., Hunter, D. R., Batchelor, C. L., & Curran, L. T. (1987). *Air traffic controller trainee selection* (AFHRL-TP-87-19, AD A187 497). Brooks AFB, TX: Air Force Human Resources Laboratory, Manpower and Personnel Division.

Tuttle, T. C., Gould, R. B., & Hazel, J. T. (1975). *Dimensions of job satisfaction: Initial development of the Air Force Occupational Attitude Inventory* (AFHRL-TR-75-1, AD A014 079). Lackland AFB, TX: Air Force Human Resources Laboratory. Occupational and Manpower Research Division.

U. S. Air Force Personnel Center (1995). *United States Air Force manual 36-2108: AFSC entry requirements*, Attachment 41 (Oct. 1994). Randolph AFB, TX: Air Force Personnel Center.

Zeitseva, E. N., & Togarev, V. F. (1985, October). System developed for psychological selection of AT controllers. *ICAO Bulletin*, 30-33.

APPENDIX A

AIR TRAFFIC CONTROLLER (ATC) JOB REQUIREMENTS SURVEY

(Occupational Survey Study Number SS05)

BACKGROUND INFORMATION

Please fill in the following information. GRADE _____ AFSC _____

NAME _____ SSAN _____

ORGANIZATION _____ BASE OF ASSIGNMENT _____

FACILITIES CURRENTLY QUALIFIED IN _____

FACILITIES HISTORICALLY QUALIFIED IN _____

TIME IN PRESENT JOB _____ yrs _____ mos TAFMS _____ yrs _____ mos
TIME IN CAREER FIELD _____ yrs _____ mos SEX M ____ F ____ (Check One)

Instructions

Please answer each one of the questions on this portion of the questionnaire by marking the area which corresponds to your *most appropriate* response.

1. How do you find your job? Choose only one.

- ☐ Extremely Dull
- ☐ Very Dull
- ☐ Fairly Dull
- ☐ So-So
- ☐ Fairly Interesting
- ☐ Very Interesting
- ☐ Extremely Interesting

2. How does your job utilize your talents? Choose only one.

- ☐ Not At All
- ☐ Very Little
- ☐ Fairly Well
- ☐ Quite Well
- ☐ Very Well
- ☐ Excellently
- ☐ Perfectly

3. How does your job utilize your training? Choose only one.

- ☐ Not At All
- ☐ Very Little
- ☐ Fairly Well
- ☐ Quite Well
- ☐ Very Well
- ☐ Excellently
- ☐ Perfectly

4. How satisfied are you with the sense of accomplishment you gain from your work? Choose only one.

- ☐ Extremely Dissatisfied
- ☐ Very Dissatisfied
- ☐ Slightly Dissatisfied
- ☐ Neither Satisfied Nor Dissatisfied
- ☐ Slightly Satisfied
- ☐ Very Satisfied
- ☐ Extremely Satisfied

5. Do you plan to reenlist at the end of your current enlistment? Choose only one.

- ☐ Will Retire (I will have completed at least 20 years of service)
- ☐ Definitely Will Not Reenlist
- ☐ Probably Will Not Reenlist
- ☐ Probably Will Reenlist
- ☐ Definitely Will Reenlist

6. While in an Air Force environment, I am made to feel uncomfortable by other individuals whose behavior is objectionable. Objectionable behaviors include such things as making derogatory comments about people because of their educational level, beliefs, sex, race, color, or national origin; using vulgar language; telling obscene jokes or stories; threatening use of violence; repeating unwanted social invitations; or hinting of job-related retaliation for denial of unwanted social contacts.

- ☐ None of the time
- ☐ Almost never
- ☐ Some of the time
- ☐ Fair amount of the time
- ☐ Most of the time
- ☐ Almost always
- ☐ All of the time

7. I feel that I, as an individual, receive an appropriate level of respect and consideration from my organization (managers, supervisors, co-workers, or support personnel) whether on or off the job for the work that I do and the manner in which I discharge my job and other military duties.

- ☐ None of the time
- ☐ Almost never
- ☐ Some of the time
- ☐ Fair amount of the time
- ☐ Most of the time
- ☐ Almost always
- ☐ All of the time

This survey is designed to capture your attitudes and opinions about various aspects of Air Traffic Controller (ATC) duties. Use the following rating scale to rate the extent that you agree with the statements in this survey. Write the number of the response that you feel bests describes your opinion in the box adjacent to the statement.

7. **STRONGLY AGREE**
6. **MODERATELY AGREE**
5. **SLIGHTLY AGREE**
4. **NEUTRAL / NO OPINION**
3. **SLIGHTLY DISAGREE**
2. **MODERATELY DISAGREE**
1. **STRONGLY DISAGREE**

Sample Question: [5] I like looking at radar scopes.

MOTIVATION SECTION

[ ] 8. I like working in fast-paced, busy environments.

[ ] 9. I like to work in an environment where I'm a member of a team.

[ ] 10. I enjoy making important decisions.

[ ] 11. I am a good listener.

[ ] 12. I am assertive.

[ ] 13. Given the opportunity to cross-train into another AFSC, I would.

[ ] 14. I really like controlling aircraft and being part of what the Air Force is really about, flying.

☐ 15. I appreciate the high level of responsibility I have as an ATC.

☐ 16. I enjoy the challenge of being an ATC.

☐ 17. Being an ATC is exciting.

☐ 18. I find being an ATC a rewarding career.

☐ 19. If a program existed where I could pursue a college education and still work irregular hours and go TDY, I would enroll.

SITUATIONAL ASSESSMENT

☐ 20. Because of the nature of the work, a good ATC waits for opinions from others before making decisions.

☐ 21. The working relationship between officers and enlisted personnel is positive.

☐ 22. Using the equipment at the ATC school at Keesler AFB, allowed me to perform my duties with minimal equipment familiarization on the job.

☐ 23. The instructors at the school showed concern for the students.

☐ 24. The instructors did what they could to improve student's chances to graduate.

☐ 25. My indoctrination training (first 3 months after 3-level school) provided valuable information about ATC responsibilities and performance expectations.

☐ 26. My upgrade training was managed in a fashion so that I was able to perform the duties expected of me in minimal time.

☐ 27. The locations where I can be assigned (PCS) are a positive aspect of the career field.

☐ 28. The length of time I spend PCS at a base is too short.

☐ 29. I go on too many Temporary Duty assignments (TDYs) a year.

☐ 30. The duration of TDYs is one of the positive aspects of the career field. (If you have not been TDY, please answer number 4, NO OPINION.)

☐ 31. I enjoy my TDY trips to other places. (If you have not been TDY, please answer number 4, NO OPINION.)

☐ 32. An ATC's responsibilities are more than an 8-5 job.

☐ 33. An ATC is provided ample opportunity to develop their supervisory/leadership skills.

☐ 34. An ATC is provided ample opportunity to develop their management/admin skills.

☐ 35. Part of an ATC's responsibility is to facilitate team performance.

☐ 36. Being an ATC will prepare me for good job opportunities in the civilian sector when I exit the Air Force.

☐ 37. Promotion rates for ATCs are higher than the average AFSC.

☐ 38. Receiving feedback/criticism about my job performance makes me a better ATC.

☐ 39. I receive my job performance feedback in a positive, professional manner.

☐ 40. If something doesn't go right with a flight, the controller is always blamed, even if it's not their fault.

☐ 41. Treatment of a mistake is more severe for an ATC than other AFSCs.

ATC ABILITIES: SECTION ONE

☐ 42. The ability to think in three dimensions while working in two dimensions is critical to successful performance as an ATC.

☐ 43. A successful ATC needs to speak clearly and concisely.

☐ 44. A good ATC enjoys talking with others.

☐ 45. A successful ATC should be outgoing and not afraid to speak to those he/she does not know.

☐ 46. To be a successful ATC, you need to be assertive.

☐ 47. To be successful, an ATC needs to be a good listener.

☐ 48. Understanding basic geometry is essential to performing the tasks of an ATC.

☐ 49. A good ATC needs to be able to handle several tasks at one time.

☐ 50. The ability to prioritize and identify what should be done first/next is critical.

☐ 51. A successful ATC is one who can assimilate information and make correct decisions quickly.

☐ 52. A successful ATC needs to be able to work well in a stressful environment.

☐ 53. The ability to anticipate what hasn't yet happened is an important factor to the success of an ATC.

☐ 54. Looking at one thing while listening to another and pushing buttons or flipping switches with your hands (head/hand coordination) is important to a successful ATC.

☐ 55. ATCs must be meticulous about how they do their job.

☐ 56. A successful ATC must be dedicated to seeing the job all the way through.

☐ 57. Ignoring some things while focusing on others is important to becoming an ATC.

ATC ABILITIES: SECTION TWO

Use the rating scale below to rate this portion of the survey. Select the response that you feel best represents *the importance of each ability to the position of Air Traffic Controller* and place the corresponding number in the appropriate box.

7. VERY HIGH - Individuals need a level of this ability that is much higher than the average enlisted person in the Air Force to successfully perform the tasks associated with this AFSC.

6. HIGH - Individuals need a level of this ability that is somewhat higher than the average enlisted person in the Air Force to successfully perform the tasks associated with this AFSC.

5. SLIGHTLY ABOVE AVERAGE - Individuals need a level of this ability that is slightly higher than the average enlisted person in the Air Force to successfully perform the tasks associated with this AFSC.

4. AVERAGE - Individuals need a level of this ability that is about the same as the average enlisted person in the Air Force to successfully perform the tasks associated with this AFSC.

3. SLIGHTLY BELOW AVERAGE - Individuals need a level of this ability that is slightly lower than the average enlisted person in the Air Force to successfully perform the tasks associated with this AFSC.

2. LOW - Individuals need a level of this ability that is lower than the average enlisted person in the Air Force to successfully perform the tasks associated with this AFSC.

1. VERY LOW - Individuals need a level of this ability that is much lower than the average enlisted person in the Air Force to successfully perform the tasks associated with this AFSC.

☐ 58. The ability to understand language, both individual words as well as words as they appear in sentences and paragraphs.

☐ 59. The ability to use language (either oral or written) to communicate information or ideas to other people.

☐ 60. The ability to perform numerical operations quickly and accurately; for example, add, subtract, multiply, and divide.

☐ 61. The ability to reason abstractly using mathematical concepts and symbols in order to change a problem described in words into a solvable mathematical equation.

☐ 62. The ability to find the most appropriate general concepts or rules which fit sets of data or which explain how a given series of individual items are related to each other.

☐ 63. The ability to apply general concepts or rules to specific cases or to proceed from stated premises to their logical conclusions.

☐ 64. The ability to memorize and retain new information which occurs as a regular or routine part of the task.

☐ 65. The ability to apply rules in order to arrange information into the best or most appropriate sequence. The types of information considered under this ability include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations.

☐ 66. The ability to shift between two or more sources of information. The information obtained from these sources is either combined and used as a whole, or is retained and used separately.

☐ 67. The ability to "hold in mind" a particular visual pattern and then find it embedded in distracting material.

☐ 68. The ability to quickly combine and organize a set of apparently different elements into a single, meaningful pattern or configuration.

☐ 69. The ability to quickly find figures, make comparisons, or carry out other tasks involving visual perception.

☐ 70. The ability to maintain orientation with respect to objects in space or to comprehend the position of objects in space with respect to your position.

☐ 71. The ability to manipulate or transform the visual images of spatial patterns or objects into other spatial arrangements.

☐ 73. The ability to produce unusual or clever responses related to a given topic or situation or to improvise solutions to problems or to develop procedures in situations where standard operating procedures do not apply.

☐ 74. The ability to exert muscular force against fairly immovable or heavy external objects in order to lift, push, or pull that object.

☐ 75. The ability to make skillful, coordinated movements of the fingers where manipulations of objects may or may not be involved.

☐ 76. The ability to make precise, steady arm-hand positioning movements where both strength and speed are minimized.

☐ 77. The ability to coordinate the movements of two or more limbs (e.g., two legs, two hands, one leg and one hand).

☐ 78. The ability to quickly pick the right action that goes with a given condition where several different actions can be selected.

☐ 79. The ability to make timed, anticipatory muscular movements to intercept or follow a continuously moving object whose speed and/or direction may vary in an unpredictable fashion.

☐ 80. The ability to get others to think or act as you would like them to, without force or coercion.

☐ 81. The ability to work with others in a cooperative manner to complete tasks or achieve goals within both small and large group settings requiring teamwork.

☐ 82. The ability to assume responsibility for the productivity, behavior, or well-being of others.

☐ 83. The ability to work productively in limited personal contact situations.

☐ 84. The ability to work productively in situations where people are angry, distressed, or tense.

☐ 85. The ability to place yourself in the situation of others and understand how they are feeling.

☐ 86. The ability to evaluate one's own performance, capabilities, and accomplishments.

If you have any comments about the questionnaire or the career field in general, please place them here. If your comments relate to a specific question please write the number of the question prior to your comment. If you need more space, continue your comments on the back of this sheet.

_____

_____

_____

_____

_____

_____

Thank you for your time.

APPENDIX B

Means and Standard Deviations of Survey Responses

Table B-1.
Means and Standard Deviations for the Job Satisfaction Questions

Survey Item	Component	Mean	SD
1	Job interest	5.6	1.4
2	Use of talents	4.5	1.4
3	Use of training	4.7	1.3
4	Sense of accomplishment	5.2	1.5
6	Made to feel uncomfortable	2.3	1.4
7	Feel respected by others	5.0	1.4

Table B-2.
Means and Standard Deviations for the Motivation Questions

Survey Item	Item Text	Mean	SD
8	I like working in fast-paced, busy environments.	6.1	1.1
9	I like to work in an environment where I am a member of a team.	6.4	0.8
10	I enjoy making important decisions.	6.4	0.9
11	I am a good listener.	6.1	0.9
12	I am assertive.	6.2	1.0
13	Given the opportunity to cross-train into another AFSC, I would.	3.8	2.3
14	I really like controlling aircraft and being part of what the Air Force is really about, flying.	5.8	1.2
15	I appreciate the high level of responsibility I have as an ATC.	6.0	1.1
16	I enjoy the challenge of being an ATC.	6.1	1.1
17	Being an ATC is exciting.	5.9	1.3
18	I find being an ATC a rewarding career.	5.2	1.7
19	If a program existed where I could pursue a college education and still work irregular hours and go TDY, I would enroll.	5.7	1.7

Note. The scale used in this section ranged from (1) Strongly Disagree to (7) Strongly Agree.

Table B-3.
Means and Standard Deviations for the Situational Questions

Survey Item	Item Text	Mean	SD
20	Because of the nature of the work, a good ATC waits for opinions from others before making decisions.	2.6	1.7
21	The working relationship between officers and enlisted personnel is positive.	4.0	1.8
22	Using the equipment at the ATC school at Keesler AFB allowed me to perform my duties with minimal equipment familiarization on the job.	3.4	1.6
23	The instructors at the school showed concern for the students.	4.5	1.4
24	The instructors did what they could to improve student's chances to graduate.	4.8	1.3
25	My indoctrination training (first 3 months after 3-level school) provided valuable information about ATC responsibilities and performance expectations.	4.1	1.6
26	My upgrade training was managed in a fashion so that I was able to perform the duties expected of me in minimal time.	5.0	1.7
27	The locations where I can be assigned (PCS) are a positive aspect of the career field.	4.6	1.6
28	The length of time I spend PCS at a base is too short.	2.9	1.7
29	I go on too many TDYs a year.	2.9	1.8
30	The duration of TDYs is one of the positive aspects of the career field.	3.8	1.3
31	I enjoy my TDY trips to other places.	4.6	1.4

Table B-3.
Means and Standard Deviations for the Situational Questions (Cont'd)

Survey Item	Item Text	Mean	SD
32	An ATC's responsibilities are more than an 8-5 job.	6.0	1.3
33	An ATC is provided ample opportunity to develop supervisory/leadership skills.	5.0	1.4
34	An ATC is provided ample opportunity to develop management/administrative skills.	4.6	1.5
35	Part of an ATC's responsibility is to facilitate team performance.	6.0	1.0
36	Being an ATC will prepare me for good job opportunities in the civilian sector when I exit the Air Force.	3.6	2.1
37	Promotion rates for ATCs are higher than the average AFSC.	2.3	1.7
38	Receiving feedback/criticism about my job performance makes me a better ATC.	5.5	1.3
39	I receive my job performance feedback in a positive professional manner.	5.7	1.3
40	If something doesn't go right with a flight, the controllers are always blamed, even if it's not their fault.	4.6	1.7
41	Treatment of a mistake is more severe for an ATC than for other AFSCs.	6.0	1.2

Table B-4.
Means and Standard Deviations for the Ability Statements (Agree-Disagree Scales)

Survey Item	Item Text	Mean	SD
42	The ability to think in three dimensions while working in two dimensions is critical to successful performance as an ATC.	6.2	1.1
43	A successful ATC needs to speak clearly and concisely.	6.4	1.0
44	A good ATC enjoys talking with others.	5.0	1.4
45	A successful ATC should be outgoing and not afraid to speak to those he/she does not know.	5.2	1.4
46	To be a successful ATC, you need to be assertive.	6.0	1.0
47	To be a successful ATC, you need to be a good listener.	6.0	1.0
48	Understanding basic geometry is essential to performing the tasks of an ATC.	4.1	1.5
49	A good ATC needs to be able to handle several tasks at one time.	6.4	0.8
50	The ability to prioritize and identify what should be done first/next is critical.	6.7	0.6
51	A successful ATC is one who can assimilate information and make correct decisions quickly.	6.6	0.6
52	A successful ATC needs to be able to work well in a stressful environment.	6.5	0.8
53	The ability to anticipate what hasn't yet happened is an important factor to the success of an ATC.	6.5	0.7

Table B-4.
Means and Standard Deviations for the Ability Statements (Agree-Disagree Scales) (Cont'd)

Survey Item	Item Text	Mean	SD
54	Looking at one thing while listening to another and pushing buttons or flipping switches with your hands is important to the success of an ATC.	6.4	0.8
55	ATCs must be meticulous about how they do their job.	6.1	1.0
56	A successful ATC must be dedicated to seeing the job all the way through.	6.2	1.0
57	Ignoring some things while focusing on others is important to becoming an ATC.	5.3	1.4

Table B-5.
Means and Standard Deviations for the Ability Statements (Requirements Scales)

Survey Item	Item Text	Mean	SD
58	The ability to understand language, both individual words as well as words as they appear in sentences and paragraphs.	5.5	1.1
59	The ability to use language (oral or written) to communicate information or ideas to other people.	5.7	1.0
60	The ability to perform numerical operations quickly and accurately; for example, add, subtract, multiply, and divide.	4.7	1.2
61	The ability to reason abstractly using mathematical concepts and symbols in order to change a problem described in words into a solvable mathematical equation.	4.4	1.2
62	The ability to find the most appropriate general concepts or rules which fit sets of data or which explain how a given series of individual items are related to each other.	5.3	1.1
63	The ability to apply general concepts or rules to specific cases or to proceed from stated premises to their logical conclusions.	5.6	1.0
64	The ability to memorize and retain new information which occurs as a regular or routine part of the task.	6.1	0.9
65	The ability to apply rules in order to arrange information into the best or most appropriate sequence (i.e., numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations).	5.9	1.0
66	The ability to shift between two or more sources of information. The information obtained from these sources is either combined and used as a whole, or is retained and used separately.	6.0	0.9

Table B-5.
Means and Standard Deviations for the Ability Statements (Requirements Scales) (Cont'd)

Survey Item	Item Text	Mean	SD
67	The ability to "hold in mind" a particular visual pattern and then find it embedded in distracting material.	5.8	1.0
68	The ability to quickly combine and organize a set of apparently different elements into a single, meaningful pattern of configuration.	6.0	1.0
69	The ability to quickly find figures, make comparisons, or carry out other tasks involving visual perception.	5.7	1.1
70	The ability to maintain orientation with respect to objects in space or to comprehend the position of objects in space with respect to your position.	6.1	1.0
71	The ability to manipulate or transform the visual images of spatial patterns or objects into other spatial arrangements.	5.9	1.1
72	NOTE: Intentionally omitted.		
73	The ability to produce unusual or clever responses related to a given topic or situation or to improvise solutions to problems or to develop procedures in situations where standard operating procedures do not apply.	5.9	1.0
74	The ability to exert muscular force against fairly immovable or heavy external objects in order to lift, push, or pull that object.	2.8	1.4
75	The ability to make skillful, coordinated movements of the fingers where manipulations of objects may or may not be involved.	4.0	1.4
76	The ability to make precise, steady arm-hand positioning movements where both strength and speed are minimized.	3.3	1.5

Table B-5.
Means and Standard Deviations for the Ability Statements (Requirements Scales) (Cont'd)

Survey Item	Item Text	Mean	SD
77	The ability to coordinate the movements of two or more limbs (e.g., two legs, two hands, one leg and one hand).	3.7	1.5
78	The ability to quickly pick the right action that goes with a given condition where several different actions can be selected.	5.8	1.3
79	The ability to make timed, anticipatory muscular movements to intercept or follow a continually moving object whose speed and/or direction may vary in an unpredictable fashion.	4.0	1.6
80	The ability to get others to think or act as you would like them to, without force or coercion.	5.0	1.3
81	The ability to work with others in a cooperative manner to complete tasks or achieve goals within both small and large group settings requiring teamwork.	5.9	1.0
82	The ability to assume responsibility for the productivity, behavior, or well-being of others.	5.7	1.1
83	The ability to work productively in limited personnel contact situations.	5.3	1.2
84	The ability to work productively in situations where people are angry, distressed, or tense.	6.1	0.9
85	The ability to place yourself in the situation of others and understand how they are feeling.	5.1	1.1
86	The ability to evaluate one's own performance, capabilities, and accomplishments.	5.9	1.1